BERMUDA

IMPERIAL BUREAU
26 NOV. 1923
OF MYCOLOGY

Reports of The

Board and Department of Agriculture

FOR THE YEAR 1922

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Board of Agriculture, 1922.

Honble. S. S. Spurling, O.B.E., M.C.P., St. Georges, Chairman.
Honble. J. P. Hand, M.B.E., Pembroke, Vice-Chairman
Col. W. R. Winter, J.P., O.B.E., Paget
E. F. Zuill, Esq., M.C.P., Devonshire
H. A. Peniston, Esq., M.C.P., Smiths
B. C. C. Outerbridge, Esq., Smiths
W. A. H. Barnes, Esq., Southampton
W. J. H. Trott, Esq., Pembroke
O. R. Loblein, Esq., M.C.P., Paget

Department of Agriculture, 1922.

Director of Agriculture—E. A. McCallan
*oPlant Pathologist (First Agricultural Assistant)—
H. H. Whetzel, A.B., M.A.
Inspector of Produce—G. E. Winter.
†Government Veterinary Officer—R. L. Tucker, D. V. S.
Second Agricultural Assistant—J. J. Outerbridge.
Clerk to Board and Director—G. L. Young.
*†Assistant Inspector of Produce—E. L. Adams.
*†Sub-Inspectors of Produce—F. W. Williams and T. H. Doe.

*Not on Civil Service Establishment.
†Not whole time officer.
oAppointment terminated 31st May, 1922.

Agricultural Station,
Bermuda,
July 18th, 1923.

Sir:—

I am directed by the Board of Agriculture to lay before His Excellency, the Governor, for the information of the Legislature, the accompanying report of the Board and Department of Agriculture for the year ended December 31st, 1922.

I have the honour to be,
Sir,
Your obedient servant,
G. L. YOUNG,
Clerk to Board of Agriculture.

The Honourable
The Colonial Secretary,
Hamilton, Bermuda.

Report of The Board of Agriculture For The Year 1922.

CONSOLIDATION OF ACTS

1. The Board feel that very great benefit has been derived by all connected with agriculture in these Islands by reason of the consolidation and amendment of all the laws relating to this industry, and they desire to express their appreciation of the work done by the Attorney General and the Director of Agriculture in the complete, concise and clear Acts which now have been placed in the Statute Book.

AGRICULTURAL DEPRESSION

2. The year 1922 has not been a very profitable one for farming anywhere, because deflation took place in this industry long before it did in any other, and farmers found themselves in the very uncomfortable position of having to pay inflated prices for practically all their supplies and for labour, while receiving deflated prices for their products.

PROFESSOR WHETZEL AND BABCOCK

3. The reports of the officers of the Department are attached and all well repay careful study, but the Board desire to draw especial attention to two reports particularly, viz: those of Professor Whetzel and Professor Babcock. The former makes it very clear that a Plant Pathologist will be a sound investment horticulturally as well as agriculturally, and the latter makes some very drastic recommendations re tenure of land, co-operative grading and packing, and forwarding. These will undoubtedly receive some serious consideration during the coming year, as the agricultural situation will probably not improve to any material extent until some of his recommendations are adopted.

INSPECTION SERVICE

4. The Inspection Service has been carried out impartially and with great benefit; and the Board feel that the plight of the Bermuda farmers would be much worse, were it not for the standard of quality maintained by this service, which has helped materially in keeping prices as high as they have been.

LIVE STOCK

5. The improvement in the health of the Colony's live stock as well as in their quality has been marked during the year under review.

ANNUAL EXHIBITION

6. The revival of the Annual Exhibition provides another incentive to the industry and brings it to the attention of the general public in an attractive as well as educational form.

CONCLUSION

7. In conclusion the Board wish to emphasize the necessity of keeping vigorous this industry for three reasons, (1) on it the Colony may have to largely depend again (as it did during 1915 to 1919); (2) because farming breeds a fine class of citizen, and (3) because the attractiveness of Bermuda as a tourist resort is to some extent dependent on the agricultural and horticultural appearance of the Colony. Special efforts must be made to preserve and develop this industry otherwise the inducements of other means of livelihood connected with the tourist business may leave the Colony depleted of its soundest and fundamentally necessary industry.

S. S. SPURLING,

Chairman, Board of Agriculture.

St. Georges, June 18th, 1923.

Report of The Director of Agriculture For The Year 1922.

The Chairman,
Board of Agriculture.

I have the honour to submit my report for the year 1922, together with reports of other officers of the Department, in accordance with the provisions of The Agricultural Department Act, 1921.

THE AGRICULTURAL STATION

Experiments with potatoes, onions and other vegetables, lily bulbs and fruit have been conducted at the Station, and a few co-operative experiments on farms. The condition of the lawns, ornamental beds, greenhouses and drives has been improved in many respects. An account of the principal work done at the Station follows:

Potato Experiments. As noted in last year's report, several strains of Bliss Triumph potatoes were under test during the season of 1921-1922, namely, (1) Maine—Long Island, that is, stock from Long Island grown from Maine seed, and identical to the stock planted throughout the Colony. (2) New Brunswick; two strains, one developed by the New Brunswick Brokers, Ltd., and the second the J. W. Smith strain. (3) Wisconsin; two strains, the first the J. W. Smith strain and the other from Sunset Farm. (4) Nebraska; grown by Mr. G. F. Forsling. (5) Batavia, New York; grown by Messrs. Hickox-Rumsey Co., Inc. Briefly the behaviour of the strains was as follows: (1) Maine—Long Island; Leaf-roll, 5 per cent.; mosaic, 16 per cent. of pronounced type; vigour of vines, inferior to other strains, and apparently less resistant to early blight and wind injury; germination, very prompt. (2) New Brunswick; Leaf-roll and mosaic, trace; vigour of vines, very good; germination, slow, even when planted as late as the first week in October. (3) Wisconsin—J. W. Smith; Leaf-roll and mosaic, trace; vigour of vines, excellent; germination, fair. Sunset Farm, Leaf-roll, trace; mosaic, 10 per cent., including extremely dwarfed plants; vigour of vines, good; germination, very slow. (4) Nebraska; Leaf-roll and mosaic, trace; vigour of vines, good; germination, very slow. (5) Batavia; Leaf-roll and mosaic, traces; vigour of vines, good; germination, very slow.

It appears that in freedom from disease and vigour of vines the new strains are superior to the Maine—Long Island strain, but so slow were they to germinate or sprout that their superiority in the former respects was of no advantage, and in yield Maine—Long Island came first. Planted in parallel rows with New Brunswick it gave 12 per cent. higher yield, and in competition with the J. W. Smith strain it yielded 32 per cent. more. So late were the remaining strains that the yields were extremely small. Where planted later different results were obtained, for example on the farm of Mr. H. R. T. Smith, St. Davids, 50 pounds each of the following strains yielded as follows: J. W. Smith, 273 lbs.; Maine—Long Island, 255 lbs.; Sunset Farm, 138 lbs.

These tests were duplicated in part at the Experimental Farm, Presque Isle, Maine, and at the Long Island Railway Demonstration Farm, Medford, Long Island. At both farms the new strains showed practical freedom from disease. In vigour of vine and yield the Forsling strain came first.

Fourteen strains of Chili Garnet potatoes from Nova Scotia were under observation in the Station field, but it is considered expedient to report on their behaviour with respect to leaf-roll in conjunction with other strains observed elsewhere in the Colony. This information will be found under "Potatoes."

Fertilizer tests were made with both crops. Comparisons of coarsely-ground and finely-ground castor pomace showed that they were practically of equal value. Tests extending over many years demonstrate the advantage of applying the fertilizer at the time of cultivating rather than at the time of, or immediately after, planting. It has been observed that the cultivation and the application of the fertilizer should take place as soon as the rows are well marked by the young plants.

Experiments extending over ten years show that one and an half ounces is the most profitable sized seed piece. The test plots are too small to give satisfactory results regarding the influence on the crop of the distances apart of the seed pieces, but nine inches by twenty-two inches is recommended. Comparative tests of dusting versus spraying were undertaken, but the high winds during the growing period of the Triumphs, and the drought during the Garnet season prevented definite results being obtained, but for the reasons given elsewhere in this report, the practice of dusting is very strongly recommended.

Onion Experiments. The experiments with onions were confined to tests of seed from different sources with respect to freedom from red-skinned and other undesirable types. The seed came chiefly from Teneriffe; some from California. Seedsmen in Teneriffe sent specially selected strains for test in Bermuda and these showed practical freedom from undesirable types of bulbs. The seed now imported contains far less admixture of red-skinned silver and bottle-necked bulbs than formerly. For the most part, the onions were seeded in rows ten inches apart, and were thinned in these rows and not transplanted. This method saves the labour of transplanting, and the distance between the rows makes cultivation easier.

Vegetable Experiments. Experiments with vegetables were chiefly tests of varieties for viability and suitability for the New York and local markets. For the most part, the seeds tested at the Station during the past ten years have germinated satisfactory. Failure in this respect is more often the fault of the seeder than the seedsman. Fourteen varieties of beans were tested. The old favourites Bountiful and Canadian Wonder compared very well with new varieties of which Soissons was the best and worthy of further trial. Forty-one strains of beet were tested and scored. Early Flat Egyptian scored slightly higher than Crosby's Egyptian; Crimson Ball, Early Wonder and Early Model are also suitable varieties. Of the cabbages tested none have been found equal

to Allhead Early and Succession. The Chinese cabbage, **Pe-Tsai,** is a vegetable recommended to home gardeners. It also finds ready sale in the local market. Of the two varieties of carrot most generally planted, Danvers and Chantenay, the latter is considered the better shaped. Swiss Chard should be planted in all home gardens. Golden Bantam sweet corn is recommended because of its earliness and flavour. Many varieties of endive were grown, and though not worth shipping to New York the vegetable is deserving of cultivation for the local market. Of the varieties of cabbage lettuce planted, none were found to be superior to Big Boston and New York. Many varieties of cos lettuce, chiefly French, were tested, and were scored by Mr. W. R. Lightbourn, who considered that of the thirty under test, nine were of superior quality, and worthy of further trial.

Lily Bulb Experiments. Plantings of the Bermuda Easter lily **(L. Harrisii)** were made by the Plant Pathologist at the Station and on the farms of Messrs. E. W. Outerbridge Co., Shelly Bay, and Mr. R. T. Burgess, Harrington Sound, for the purpose of studying black scale and other diseases and their control, and demonstrating the benefits following the careful selection of planting stock. Other experiments in selection carried on by Mr. H. E. D. Smith, St. Davids, were also under observation. The subject is treated further by the Pathologist.

Fruits. Some citrus trees, chiefly grapefruit, bore well. The use of the miscible oil spray, brought to our attention by the Pathologist, has cleaned the trees completely of purple scale **(Lepidosophes beckii),** and there has been no difficulty experienced in keeping the trees clean of this pest and of cloudy white fly **(Dialeurodes citrefolii).** Many trees are badly affected with gummosis, against which no control measures have proved effectual. The loquats fruited heavily, and were comparatively free from injury by the Mediterranean fruit fly **(Ceratitis capitata).** The fruit of the Advance loquat imported in 1917 has proved to be much inferior to that of the older trees. The avocados bore no fruit, nor have they fruited to any extent at any time during the last ten years; the cause is undoubtedly powdery mildew. Application of sulphur dust to figs and papaws proved beneficial in the control of rust and mildew. The Schley pecans donated by the late F. C. Thoma have grown well. The site of the new orchard has been cleared of cedar and plowed, but it is not yet enclosed.

Lawns, Ornamental Beds and Glasshouses. The lawns, ornamental beds and glasshouses have been maintained in good order. Nearly all the lawns received a top dressing of soil. During the latter part of the year a Sprywheel side-cutting lawn mower manufactured by Messrs. H. C. Dodge, Inc. of Boston, Mass., and loaned by Mr. R. E. Gunn of Toronto for test was in use, and appears to be well suited to local conditions. Wild ferns transplanted in the ruined cottage on the south bank are becoming well established. The following are represented: **Osmunda regalis. O. cinnamomea. Acrostichum excelsum, Polypodium plumula, Pycnodoria longifolia, Pteris caudata. Adiantum bellum, Anchistea virginica, Asplenium dentatum, A. heterochroum. A. monteverdense, Polystichum adiantiforme, Dryopteris normalis, D. Thelypteris. D.**

D. bermudiana, D. speluncae, and Nephrolepis exaltata. Specimens have not been found of **Anopteris hexagona** and **Diplazium Laffanianum.** The pergola has been repaired and planted to a variety of flowering plants. At the close of the year work was begun on the improvement of the north entrance on Point Finger Road.

The Department is indebted to the Royal Botanic Gardens, Kew, through Miss Mary Hunter; Dr. A. Robertson Proschowsky, Nice, France; Prof. H. H. Whetzel, Cornell University, New York; Mrs. J. Montgomery Sears, Boston, Mass.; Miss Edith Allen, Miss May Hutchings, Miss Rigby, the late Mr. F. C. Thoma, Mr. S. W. Andrews, Mr. A. D. Hollis and Mr. C. A. Baker for donations of seeds, cuttings and plants.

Green Manuring. Nearly all the experimental plots were sown to cowpeas and soy beans during the summer, but as the seedings were for the most part late, the crop plowed under as green manure was light. For the last ten years a part, if not all, of the plots have been thus treated, and the value of leguminous green manuring has been well established. The practice is very strongly recommended.

Live Stock. The live stock owned by the Department consists of two Ayrshire bulls ,two Guernsey bulls and two cows and a bull calf of the last named breed. Through the kindness of James Morgan, Esq., Southlands, Warwick, the young Ayrshire, Pinebluff Laddie, was cared for on his farm throughout the year. The old Ayrshire, Hillside Spicey's Laddie, continued to improve during the year, and is a large rugged animal, but very slow at service. The Guernsey bull, Albamont Adonis, has increased in weight since his purchase last year, but defects have rendered him unfit for service. On January 6th, the Guernsey cow Dora of Atwood's Dairy dropped a fine bull calf. This animal, Montrose Sovereign, has developed into an unusually good yearling. Albamont Juliet dropped a bull calf on January 25th, which was found dead. Both cows are probably in calf to Don Diavolo's Bermuda Pioneer, the property of Mr. B. C. C. Outerbridge, Smiths. Proper stabling and fencing are urgently needed.

Disposal of Milk and Vegetables. During the year 2,230 quarts of milk were given to the King Edward VII Memorial Hospital, and the remainder was used by the staff and fed to the calf. Vegetables, including 33 barrels of potatoes were given to the Hospital, Hamilton Gaol, the Lunatic Asylum, and to charitable bazaars. An experimental shipment of Triumph potatoes was made to England, and is dealt with elsewhere in this report. Under "Reimbursements" will be found the value of produce sold and otherwise disposed of.

Labour. In the early part of the year great difficulty was found in securing labour. Since then advanced wages have been paid to a better class of men with fairly satisfactory results. The use of an electric pump, hose in place of watering cans, a motor lawn mower and the substitution of dusting in place of spraying have reduced hand labour. The field staff consists of seven men at an average daily wage of eleven shillings.

Office Work. The office work has increased, and the reduced staff cannot properly perform it. During the year 856 letters were received and 1,308 dispatched, exclusive of circular letters and postcards. Regulations were made governing the inspection of bulbs and other nursery stock, the control of infectious animal diseases, the control of the palmetto scale and the sale of vegetable seeds. Early in the year considerable progress was made in indexing and filing bulletins received. Since June the Agricultural Bulletin has been published monthly, and articles are sent to the local newspapers at irregular intervals. Market quotations received by cable from the Department's representative in New York are made public. Testing vegetable seeds and issuing certificates of bulb inspection absorb much time. All clerical work connected with the exhibition was performed by the office staff. The purchase of a mimeograph and mimeoscope makes it possible to more frequently issue information, but has increased office work. The office hours are from 8.30 a. m. to 5 p. m.

Extension of Station Grounds. Little has been done during the year to fit Montrose lands for station and exhibition purposes. The Works Department removed from the land and rough walls 16,785 bushels of hard stone for road metal, and 1,260 bushels of stone for concrete. Hamilton Gaol received a number of loads of fire-wood. The Works Department has erected in place of one wall removed a neat strong woven wire fence 700 feet long, fitted with cedar stiles and gate; a road about 200 feet long has been constructed. Boundary and other fences are much needed.

The grounds proved well adapted to the purpose on the occasion of the Annual Exhibition, and the work of fully adapting them to this purpose and for experimental fields and pasture lots should be proceeded with without undue loss of time. The Agricultural Station is within easy walking distance of the most thickly populated parts of the Islands, and at moderate cost could be made into an attractive botanical station without lessening its value as an agricultural station.

Visitors. His Excellency the Governor, Sir J. J. Asser, has visited the Station on several occasions. Among the distinguished foreign visitors were Dr. L. H. Bailey, the noted botanist and horticulturist and formerly Dean of the New York State College of Agriculture, and Dr. Henry Fairfield Osborn, President of the New York Zoological Society and a widely known archaeologist. Dr. Bailey has identified many plants on the Station grounds during his visit to the Colony and since his return. The number of visitors is increasing, but too few farmers are included in the numbers.

THE AGRICULTURAL YEAR OF 1922.

The year 1922 was one unfavourable to Bermuda agriculture. The cost of production was about 110 per cent. higher than in 1914; agricultural exports were 74 per cent. of the average of the last ten years, and though selling prices generally were higher than in pre-war days, there was little, and in some cases no profit. It is encouraging to note that production casts are falling. Labour,

however, shows neither decline in cost or improvement in efficiency. The contemplated importation of farm labourers from the Azores should greatly improve labour conditions. Several causes combined to reduce the crop. In the first place, there was some reduction in the area planted; up to 5th December, 1921, Bliss Triumph potatoes gave promise of an unusually large crop, but the high winds on that and subsequent dates greatly reduced the yield which was further reduced by early blight (**Alternaria solani**); and the severe drought during the latter part of the season seriously reduced the crop of Chili Garnets and other vegetables, and unfavourably influenced their quality. The small crop of onions was chiefly due to reduced acreage, though pink-rot (**Fusarium malli**) was an improtant contributing cause. Compared with the ten years' average, the quantities shipped were as follows: potatoes, 70; green vegetables, 92, and onions, 59. Production for home consumption showed some increase. For many years it has not been customary to consider the Easter lily crop because it had shrunk to insignificant proportions, but recently the industry has improved, and the season's shipments were worth to the growers at the packing sheds about £8,000.

Details of the quantities of poduce shipped will be found in the report of the Inspector of Produce.

POTATOES

The outstanding feature in connection with potatoes is the amount of leaf-roll that appeared in Chili Garnets in Bermuda in the winter of 1922. Seed potatoes had been carefully inspected in Nova Scotia the previous summer, and none showing more than 4 per cent. were accepted of the 84 fields accepted 74 contained 2 per cent. or less, and the acreage condemned was much larger than usual. Despite this, in the latter part of February complaints were received of much leaf-roll throughout the Colony. The Plant Pathologist and the Director visited many fields, and forty-three strains or marks were observed and counts taken of the percentages of leaf-roll. The results were as follows:

Origin of Seed	0% to 10%	11% to 40% & over*	Total
Clifton	24	1	25
Masstown	5	0	5
Cornwallis	4	7	11
Grand Pre	1	0	1
Windsor	1	0	1
Totals	35	8	43

*Included in this column are four barrels which contained from 80% to 90%.

Having regard to the care exercised in inspection in Nova Scotia, the amount of leaf-roll evident in the crop in Bermuda was extremely disappointing, though by no means were conditions as bad as many farmers feared.

Leaf-roll and mosaic of the potato are transmitted by the pink and green aphid (**Macrosiphum solanifolii**) and for this knowledge potato growers are indebted chiefly to Dr. Edith M. Patch, Entomologist and Dr. Donald Fulsom, Pathologist of the Maine Agri-

cultural Experiment Station, and Dr. E. S. Schultz, of the United States Bureau of Plant Industry. Other natural ways there may be by which these two diseases are spread, but the aphid is considered to be the chief agent. The percentage of disease increases more rapidly in localities and during seasons favourable to aphids. No study ha sbeen made of the seasonal distribution and localisation of potato aphids in Nova Scotia, but it appears that the unusually warm dry summer of 1921 created conditions exceedingly favourable, and that the insects were more numerous in the Cornwallis Valley than in the other Garnet seed centres.

The consistent behaviour of strains in Bermuda during the winter of 1922 and in Nova Scotia in the following summer was most striking, and again and again were the percentages of infestation almost duplicated. This is shown by the following examples:

Mark	Nova Scotia, 1921	Bermuda, 1922	Nova Scotia, 1922
A	2 2-3%	25%	28 1-3%
B	1 1-3%	36%	37 1-2%
C	2-3%	23%	21 %

When it is considered that not until 1922 was the possibility of leaf-roll infestation by aphids considered when inspecting Chili Garnet seed in Nova Scotia and control measures against it taken, it is difficult to understand why the disaster of last winter had not happened many times before.

In the summer of 1922 the inspection of seed was very rigid. In more than one case clean fields were not accepted because of the proximity of infested potatoes. Every case was considered on its own merits, and decisions were arrived at after consideration of the percentage of leaf-roll then present, the past behaviour of the strain, the proximity of leaf-roll, the reliability and intelligence of the grower and other factors. Last year's experience shows that less than one per cent. of infestation is not safe in a season favourable to aphids, but the cool wet summer of 1922 may be considered unfavourable. Mr. W. K. McCulloch, the Dominion Inspector, is indefatigable in his efforts to secure absolutely clean stock, and the growers have full confidence in him. Without his hearty cooperation, it would be impossible to secure the results aimed for, and I gratefully acknowledge my personal indebtedness to him.

The future of the Chili Garnet seed situation in Nova Scotia is full of promise. The growers, or a majority of them, are alive to the requirements of certified seed potato production, and under the direction of Mr. McCulloch may be expected to further improve their strains. It is regretable that the commercial end is not in better shape, for annual bickering over the price of seed does not promote good seed production.

The Bliss Triumph seed situation is not as satisfactory as that of the Chili Garnets, and radical changes should be effected. With this variety mosaic is the most serious disease, and though it is not recognized as such by Bermuda potato growers, it reduced their profits none the less. Excellent disease-free stock is obtainable, but up to the present it has not been possible to sufficiently interest the growers in Long Island and the Bermuda importers and farmers in the acquiring of better seed for Long Island.

The Director's visit to Maine last summer confirmed the impression of the previous summer, namely, that there is no good stock in the locality that has been supplying Long Island and Bermuda for many years. The best in the vicinity of Van Buren contained thirty per cent. and a small field near Frenchville with but half that percentage was accepted, but was afterwards sold elsewhere. Coming down to Long Island we find that the seed is planted chiefly by men without knowledge of seed potato production, and the small quantity ordered from Bermuda during the past two or three years has discouraged the firms who finance the Long Island farmers, and they are not willing to change their methods and endeavour to produce better seed, indeed nearly all have gone out of the business entirely. So much for the discouraging features of the situation.

Turning to matters for encouragement it is pleasing to know that high-producing, disease-free strains of Bliss Triumphs are obtainable. Prof. J. G. Milward of the Wisconsin State College of Agriculture and Prof. H. O. Werner of the Nebraska State College of Agriculture have been very helpful in securing for the Department reliable seed which has been tested in Maine, Long Island and Bermuda, and its freedom from disease has been established. During his assocation with the Department, Prof. H. H. Whetzel of Cornell University was able to interest Messrs. Hickox-Rumsey Co., Inc. of Batavia, New York, and this firm is in position to supply Bermuda with the very best seed potatoes. If the New Brunswick Brokers, Ltd. can deliver to Bermuda seed that will germinate sufficiently early, that source of seed might with advantage be enlarged. Dr. H. C. Sands who has assisted the Department for many years in the selection of Triumph seed, and to whom I am deeply indebted, is now engaged in the production of certified seed potatoes in Maine, and has expressed his willingness to grow Bliss Triumphs for Long Island and Bermuda. Director H. B. Fullerton of the Long Island Railroad Demonstration Farm is of opinion that uninfested areas can be found in Long Island in which to grow clean seed. Mr. W. H. Allen has luckily found in New York State an early disease-free strain which was tested in Bermuda last fall and gave good promise. The small quantity in his possession Mr. Allen proposes to increase, and he should soon be able to supply a quantity of good seed.

Potatoes are likely to remain the Colony's most important crop. Reliable seed and the control of pests and diseases are alike necessary. As is shown in the following table, the exports of potatoes in 1922 was the second smallest during the past ten years.

1913	53,102	barrels
1914	41,532	"
1915	51,519	"
1916	55,166	"
1917	74,574	"
1918	69,453	"
1919	91,777	"
1920	54,031	"
1921	58,955	"
1922	43,651	"

ONIONS

The Colony's exports have seriously decreased during the last thirty years, as the following figures show:

Ten years ending 1900 annually .....315,715 crates
Ten years ending 1910 annually .....279,991 "
Ten years ending 1920 annually .....128,000 "

In 1921 there were exported 49,464 crates and in 1922, 70,874 crates. Almost always it is inferior seed and Texas competition that are put forward as the causes of the decline, but the causes are probably in this order of importance: (1) pink-root, (2) thrips, (3) inferior seed, (4) occasional outbreaks of blight, (5) increased acreage planted to other vegetables, and (6) competition from Texas.

The onion is essentially a Bermuda product, for these Islands have given their name to this variety of seed, and Texas can with propriety use the term "Bermuda." The passing of this vegetable is viewed with regret, for its cultivation does not call for a heavy outlay for seed as does the potato, and it can be grown on soils and in localities unsuitable for other crops. The obstacles to its cultivation are in no case insurmountable, and of them all pink-root is the chief. Its control is simple. Seed should be sown in new land if at all practicable, that is, land that has not recently been cropped with onions, or the seed beds should be treated with one part of 40 per cent. formaldehyde to fifty parts of water. From half to one gallon of the solution per square foot of soil is required, and the cost for material would be from 12— to 25— per rod, probably a prohibitive price. Much, however, can be done by keeping the plants well nourished, and onion land should be generously manured, and the plants should be kept green by two or more applications of nitrate of soda at the rate of two-third pounds per rod. An accidental application of nitrate of soda to a few yards of bed on the farm of Mr. Antone Marshall, Paget, gave striking illustrations last season of the value of this treatment. That timely dusting with nicotine dust will effectually control thrips when this pest appears in warm dry seasons was indicated by tests made by Mr. J. H. Young, Sandys. Reliable seed producing straw-coloured bulbs of uniform shape can be purchased in the Canary Islands, and there is no excuse for further importations of seed containing in some cases as high as seventy-five per cent. of red and pink bulbs. Farmers should ascertain the origin of the seed purchased by them. The occasional disaster of blight (**Peronospora Schleideniana**) can be averted to some extent by early dusting with copper-lime dust. So infrequent has the appearance of this disease become that it is not generally recognized in time to take precautionary measures against it. Texas competition may be overcome by selling in Canada, for the consumption of onions in that country during our season exceeds our present production.

Exports to Canada during the last five years were as follows:

		Percentage of total exported
1918....	7,382 crates	6
1919	11,564 "	8

1920	8,582	"	8
1921	12,544	"	24
1922	21,323	"	30

The subject of the Canadian Market is further treated under "Selling the Crop."

GREEN VEGETABLES

During the past ten years exports of green vegetables have been as follows:

1913	144,081	crates
1914	167,896	"
1915	194,665	"
1916	252,333	"
1917	209,894	"
1918	63,976	"
1919	162,517	"
1920	260,784	"
1921	263,649	"
1922	191,806	"

As already stated, the high cost of production and scarcity of labour were the most important factors in reducing the quantities of green vegetables and other produce shipped. Aside from the causes named, it is probable that greater variety in the vegetables exported would increase sales in New York. The exports to New York in 1922 were made up as follows: carrots, 39 per cent.; parsley, 24 per ceit.; celery, 16 per cent.; beets, 14 per cent.; all other green vegetables, 7 per cent. In his report the Inspector of Produce again calls attention to the desirability of introducing other kinds of vegetables and states that as a general rule the market will accept larger quantities of fava and other kinds of beans, kohl-rabi, peas and turnips. He also recommends the experimental planting and shipment of new vegetables which he names.

Dusting experiments to control celery blight (**Septoria pertoselina var. apii**) were conducted on the farm of Mr. Fred E. Smith, Smiths, and were highly successful. For the same farm two fertilizers were mixed at the Station, one having tankage as the chief source of nitrogen and the second dried blood, and these were applied on the same field in place of the usual applications of nitrate of soda, the excessive use of which is the cause of black-heart. Both fertilizers, but especially the first, gave excellent results. So good were the results obtained that a special fertilizer to be compounded according to the formula used was ordered from England for the next season's crop. The Inspector of Produce received from Mr. F. E. Tether, Ridgewood, New Jersey, a sample of celery seed, this, with samples imported from France, was sent to celery growers for planting in the season of 1923.

The Board of Agriculture has had under consideration for some years the registration of seedsmen, and late in 1922 regulations were made governing the sale of vegetable seeds, and under its provisions, on and after July 1st, 1923, it shall not be lawful for any person or firm not registered to sell or offer for sale vegetable seeds in these Islands. The regulation further restricts the varie-

ties of beet, carrot, celery, cos lettuce, onion and parsley, and requires that samples shall be forwarded to the Director of Agriculture for test, and that all containers shall be labelled as prescribed. In addition to the vegetables named, the following also come within the meaning of the regulations: beans, cabbage, cauliflower, field and sweet corn, cucumber, egg plant, cabbage lettuce, kohlrabi, musk and water melons, pea, tomato and turnip.

In dealing with the subject of green vegetables attention is directed to the local demand in winter for greater variety including choice vegetables such as beans, cauliflower, celery, egg plant, head lettuce, peas and tomato.

BERMUDA EASTER LILIES

Under the provisions of The Agricultural Inspection Act, 1921, regulations have been made governing the inspection of bulbs and other nursery stock exported from these Islands. The inspection of all bulbs is required. It is desirable if the cost is not prohibitive, to further regulate the exportation of bulbs by making official field inspection a condition of certification, for only by this method can the presence be detected of bulbs not of the true (**L. Harrisii**) type, and in the interests of the industry only bulbs true to type should be exported as Bermuda Easter lily bulbs.

The presence in Bermuda of Prof. H. H. Whetzel did much to interest grows in the improvement of their stocks by the elimination of bulbs susceptible to disease, and the further control of disease by proper control measures. Successful lily culture demands close attention and study, and it is not every farmer who can grow builbs with profit.

During the year enquiries have been made in England and Canada with respect to the sale of bulbs, and there is reason to believe that shipments to England, interrupted by the war, may be again resumed. Bermuda lily bulbs are of better quality than ever before, though further improvement is desirable, and wisely handled, the trade should increase.

Shipments during the past ten years have been as follows:

1913	2,357	cases
1914	941	"
1915	881	"
1916	1,224	"
1917	1,009	"
1918	823	"
1919	690	"
1920	749	"
1921	936	"
1922	1,604	"

Exportation to the United States of nearly all other kinds of nursery stock is prohibited by the plant quarantine regulations of the Federal Horticultural Board, and markets have not been found elsewhere. Many kinds of nursery stock could be cultivated here if there existed profitable markets. The Department is under obligation to Dr. Theodore Outerbridge and Mr. L. M. Outerbridge for services in connection with the hearing of the Federal Horti-

cultural Board, Washington, with respect to the importation of bulbs into the United States of America.

Regulations made during the year deal with the inspection and certification of nursery stock exported from these Islands, and of the packing material used.

FRUIT

By the use of miscible oil emulsion the purple scale (**Lepidosophes beckii**) can be controlled on citrus trees, and its use should be equally well suited to the control of other kinds of scale on other fruit trees. Once clean it is a comparatively easy task to protect fruit trees from further infestation. Other pests and diseases can be controlled by other methods, and if one is sufficiently interested in growing fruit to pay the price of eternal vigilence against the depredations of bug and disease, fruit can be grown, nor is the price as high as the above might indicate. Clean trees will bear as heavily today as in the golden age of the past.

The only serious pest in addition to the purple scale is the Mediterranean fruit fly (**Ceratitis capitata**) which is less numerous than formerly. Control measures should include spraying the trees before the fruit ripens and every 10 to 14 days during the time ripening fruit remains with the Mally poisoned bait, which consists of 2 1-2 lbs. sugar, 3 ozs. arsenate of lead (paste) and 4 gals. water. All ripened fruit should be removed and fallen fruit picked up. Fruit and debris likely to contain eggs or larvae should be destroyed. The extermination of this pest is deserving of far greater attention than it now receives. Its control and the control of all other pests and diseases of fruit trees is more a matter for popular co-operative effort than for Government regulations and fines.

THE CONTROL OF PLANT DISEASES AND PESTS

The association of Prof. H. H. Whetzel with this Department for the period of a year in 1921-1922 aroused public interest in the subject of plant diseases and pest control to no small extent, and during the time he held office as Plant Pathologist the farmers of the Colony and others interested in the growing of vegetables, fruits and flowers received very valuable information in modern methods of control. It is to be deeply regretted that circumstances have prevented the office of Pathologist being again filled without loss of time. A trained scientist who has secured the confidence of the farming community will save the Colony annually a sum very many times greater than his salary, for it should be recognized that Bermuda agriculture loses yearly through neglect to effectively control plant diseases and pests more than by any other one cause, possibly more than by all other causes combined.

To Prof. Whetzel the Colony is indebted for the introduction of dusting as a means of controlling plant diseases and pests. Briefly stated the most important advantages of dusting over spraying are as follows: (1) Much more quickly done, hence a great saving of time and labour is effected. (2) More convenient. There is no water to carry, no mixing, no wet clothes, no mess, no loss of temper. It is a clean dry job that is soon over. (3) More timely and frequent applications can be made. Fungicides should

be applied, as a rule, immediately before rain, and a fairly large field can be dusted after signs of rain are evident. (4) More efficient. Dusting gives better distribution and so affords better protection. (5) Costs less, if the cost of labour is included.

As farmers get better acquainted with the kinds of dust suitable for different diseases and pests, become more proficient in the technique or method of applying the dusts, and are furnished with a better duster, much more satisfactory results will be secured than at the beginning, and the practice of dusting will be followed much more generally than spraying was ever followed. Until plant diseases and pests are effectually controlled, farming in Bermuda will be "less a profession than a disease."

In last year's report much space was devoted to the oleander scale (**Aulacaspis pentagona**) and its control. This pest is the most serious introduced into Bermuda for many years. Its favourite host plant is the oleander, hence its local name, but it has been found on many other plants.

Spraying with lime-sulphur solution by means of the two Departmental power pumps was continued during the year at a cost of £3,092. During this time infested oleanders were sprayed throughout the greater part of St. Georges, Southampton and Sandys, in parts of Warwick, and along the public roads in Hamilton Parish, Smiths, parts of Devonshire and Paget. As stated in last year's report, much valuable time had been lost before spraying operations were begun, and it was found impossible to keep pace with the pest last summer. Lime-sulphur applied by power pumps effectually controls the scale if put on once or twice yearly, but it was impracticable to spray once throughout the Colony within the year, and many localities, including the entire parish of Pembroke, were not sprayed. What would have been the appearance of Bermuda to-day had not spraying been undertaken is illustrated by the condition of the oleanders at Elba Beach, Spanish Point and other localities where no spraying was done. On the other hand, the healthy condition of oleanders over the greater part of St. Georges and Somerset and in other localities where sprayed is evidence of the efficacy of spraying with lime-sulphur.

The following record of a careful examination made by Major S. C. Hicks on the 17th November, 1922, of the oleanders on his grounds should convince the most sceptical.

(1) Sprayed with power pump in November, 1921, were not pruned or cleaned before sprayed, 34 clumps treated; condition to-day—19 free from scale, 8 slightly infested, and 7 badly infested.

(2) Sprayed with hand pump in July, 1922, pruned and cleaned before sprayed, 3 clumps treated; condition to-day—3 free from scale.

(3) Sprayed with power pump in November, 1921, and again sprayed with hand pump in July, 1922, about 10 were pruned and cleaned before sprayed with hand pump, and all of these are free from scale today, 33 clumps treated; condition to-day—15 free from scale, 12 slightly infested, and 6 badly infested.

The spraying done on Major Hicks' property in November,

1921, was at the time of the trials of the power pumps and with a solution weaker than that afterwards used, yet about fifty per cent. of the clumps so treated were free from scale a year after. The so-called "pet tree" of Prof. Whetzel, that is, the one growing on the roadside at Harbour View, Paget, was treated by him on 18th July, 1921. The solution was applied with a paint brush, as the Department was not then in possession of pumps. With this treatment the tree remained free from scale for a year. The Department has never claimed better results from spraying than was obtained in these two instances, which are duplicated all over the Colony.

It is pointed out, however, that the policy of spraying at no cost or obligation to the land owners benefitted carried within it the seeds of failure, nor was it recommended by the Department. As a general rule, the owners of infested trees have done little and often nothing to assist the Department in the control of the scale. A few exceptions there have been, notably Mrs. T. St. G. Gilbert, Somerset, and Rev. F. M. Brunton, St. Georges. Further, it is also pointed out that spraying was taken up as a temporary measure only, and as a form of first aid. At no time was it considered practicable to successfully control the scale by this method above. Concurrently with the first spraying operations enquiries were made concerning other methods of control, and it was early recognized that the importation and colonization of a predaceous enemy of the scale would in the end probably prove to be the best means of control. Mention was made last year of the parasite fly, **(Prospaltella berlesei)**, received from Dr. L. O. Howard, Chief of the Bureau Entomology, Washington. Early in the year under report a large quantity of breeding material of two species of **Prospaltella, P. berlesei** and **P. Diaspedicola** was received from Prof. F. Selvestri of the R. Laboratorie di Entomologia, Agraria, Portici, Italy. Surveys made at the close of the year showed that the fly was established in some of the localities in which it had been liberated. Arrangements have been made with Prof. Selvestri whereby very much larger quantities of these and other pradaceous enemies of **Aulacaspis** will be sent to Bermuda in 1923. The introduction of these insects carries with it no risk of adding to the Colony's pests, but should prove a natural and economical method of controlling the oleander scale.

The palmetto scale **(Comstockiella sabalis)** is another example of an imported plant pest. Discovered in November, 1921, on a palmetto in Somers' Garden, St. Georges, it spread to all palms of this species within the town. All infested trees were sprayed and subsequently destroyed, and the scale has not been discovered elsewhere in the Islands.

Occasion is here taken to thank the Furness Bermuda Line for bringing down from New York free of cost all lime-sulphur used in spraying.

INSPECTION SERVICE

Under the provisions of the Agriculture Inspection Act, 1921, the inspection service has been satisfactorily performed during the year, though shortage of Sub-Inspectors has caused inconvenience at times. As will be seen by his report, the Inspector of Pro-

duce, Mr. G. E. Winter, was absent from the Colony on duty from 4th February to 12th June, during which time Mr. E. L. Adams, Assistant Inspector, was in charge of inspection in Bermuda. In addition to the inspection of exports of produce, the service now inspects lily bulbs for export, and imports of seed and other potatoes and nursery stock. The latter has included the inspection of all bulbs, and plants imported through the Post Office, which inspection has been performed by the Director and the Second Assistant.

The Government Veterinary Officer, Dr. R. L. Tucker, is able to report freedom from dangerous infectious animal diseases, due in no small measure to the manner in which Dr. Tucker has inspected all imported animals. His report is found elsewhere.

LABOUR

Shortage of labour is the most important factor in maintaining the high cost of production and in reducing the area under cultivation. Immediately on his arrival in the Colony in August, His Excellency the Governor, Sir J. J. Asser, took a deep interest in the local labour situation, especially in its relation to agriculture, and it was largely due to the interest exhibited by him that the Immigrant Labour Board took action late in the year under report to import about one hundred agricultural labourers from the Azores.

A report of a sub-committee of the Board on the subject of agricultural labour may be found on a subsequent page.

LABOUR-SAVING TOOLS

The present high cost of labour is turning the attention of Bermuda farmers to labour-saving tools and other means of reducing labour costs. It should be recognized, however, that in the growing of truck crops a maximum of hand labour is required, and the limited area of the farms, the smallness of the fields, their uneven surfaces, the frequent presence in them of fast rocks, the lack of weight in our horses, the use of single-horse teams, and the character of local farm labour all mitigate against the use of labour-saving tools and implements. Yet many improvements and economies can be effected, and some are now being put into practice; for example, the rapid change from the use of sprayers to dusters is shortening labour bills as much, if not more, than will any other change of method that can be made. Dusting is the greatest labour-saving change that the Bermuda farmer can ever hope to make. Planting potatoes by machinery, the seeding of onions in permanent drills, the use of seeders and horse cultivation of potatoes, are more or less comparatively new methods that are being adopted more generally every year.

It is regretted that the nature of the experimental work carried on at the Station and the absence of any vote prevent the Department from experimenting, in the use of labour-saving tools to the extent that is desirable. Often opportunities are offered to test tools that appear suitable, but seldom can the opportunity be embraced.

It appears that the greatest economy should be effected by:

(1) Improvement in the transportation of crops to market. An eight mile haul of eight barrels of potatoes in a one-horse wagon is a waste of both man and horse labour. As the majority of Bermuda farmers are insistent that the use of two-horse teams is impracticable, relief should be looked for elsewhere, either by improved water or land transportation. (2) Use of larger and better plows. Many fields are sufficiently large to permit the use of two-horse walking plows, and it is not unreasonable to suppose that a better type of hill-side plows could be obtained for use on smaller and more uneven fields. (3) Use of potato machines for planting and digging. One-horse implements of light draft would be most popular, but two-horse implements could be used on the larger farms, provided they were sufficiently light for the type of horse used locally. The closeness of cultivation (twenty to twenty-two inches between rows of potatoes) is an hinderance to the use of all horse-drawn tools, and it might be an economy to set the rows wider in potatoes and other crops in order to render practicable the use of horse tools. (4) The more extensive use of cultivating implements. Their use cannot become general, however, until Bermuda farmers realize the advantage of killing weeds before they live, that is, by frequent shallow cultivation to prevent the germination of weed seeds. Tractor cultivators of every size and description are now manufactured, and many of these should be found adapted to local use.

The co-operative ownership of the larger and higher priced implements is recommended. Many farmers who cannot afford to individually own a potato digger, for example, would find it to their advantage to own one jointly with a few neighbours.

SELLING THE CROP

With the object of securing expert opinion on the marketing and distribution of the Colony's crops, during the winter of 1922 the Board invited Prof. H. E. Babcock, Ph.B., Professor of Marketing at the New York State College of Agriculture at Cornell University, to visit the Colony for the purpose of observing and reporting on the marketing of Bermuda produce in New York. Prof. Babcock first spent a few days with the Inspector of Produce in observing conditions in New York. In Bermuda he interviewed farmers, landowners, shippers, the officers of the Bermuda Green Vegetable Growers' Association and others interested in local agriculture. He addressed meetings and attended conferences, and much was crowded into the few days he was in the Colony. This very valuable report deals with (1) land ownership, (2) cheaper production, (3) grading and packing, (4) assembling, (5) forwarding, (6) transportation and (7) distribution; the report may be found in full on another page. The Board has adopted some of the minor recommendations made by Prof. Babcock.

The Agricultural Inspection Act, 1921, and Regulations made thereunder came into operation during the year under report. The Act consolidates seventeen former acts dealing with produce, green vegetables (included in produce in the new act), seed potatoes, bulbs and vegetable seeds. Many amendments of the former acts were made, the most important of which are (1) the Inspector of Produce is now a whole time officer, (2) standard grades and packages have been extended, (3) the inspection of

bulbs and other nursery stock intended for export has been made compulsory, and (4) the registration of vendors of vegetable seeds will be required after 1st July, 1923. These regulations, dealing with local produce intended for shipment abroad, should further improve their quality and effect beneficially their sale. The Board has under consideration additional regulations of similar nature.

The Agricultural Inspection Act makes provision for the employment abroad of a member of the inspection service, and the Inspector was in New York during the greater part of the season of 1921-1922. The Inspector informs the Director by cables and letters regarding market prices of Bermuda produce and other matters regarding market conditions, and this information is published locally by telephone, notices posted at the dock and elsewhere, post-cards and through the press. The Inspector advises the receivers regarding crop conditions in Bermuda, and is able to a limited degree to prevent price cutting. He is also able to direct the attention of the sseamship company to transportation matters calling for improvement, and this opportunity is taken to express the Department's appreciation of the readiness always exhibited by the Furness Bermuda Line to assist Bermuda agriculture in every way within its power.

During the year the Board has had under consideration the licensing of shippers, and the control through them of receivers of Bermud produce. This drastic step had been contemplated because of the multiplication of both shippers in Bermuda and receivers in New York, and the resultant cutting of prices and other evils. To improve conditions in the New York market and to prevent similar conditions arising in the growing Canadian market is the object of the legislation recommended by the Board.

The United States of America continues to be the Colony's best customer. Of the total quantities exported in 1922 there were shipped to New York the following percentages: potatoes, 96 per cent.; onions 53 per cent.; other vegetables, 99 per cent.; and lily bulbs, 99 per cent. It is recommended that concurrently with efforts made to extend the sale of Bermuda produce in Canada and other new markets, efforts should be made to stimulate sales in American cities other than New York. The condition reported in 1917 by the former Director, Mr. E. J. Wortley, namely that 'ridiculously small quantities' of the Colony's vegetables were then finding their way to these outside cities, exists to-day. Our produce should be distributed over a larger area in the United States.

Bermuda was again represented at the Canadian National Exhibition held annually in Toronto. The agricultural exhibits were better than those shown the previous year, both in quantity, quality and staging. The publicity thus secured should result in increased agricultural exports to the Dominion. It is recommended that the Colony's booth be exhibited at other Canadian fall shows. Following the Toronto Exhibition, the Department's representative, Mr. J. J. Outerbridge, Second Agricultural Assistant, visited nine large Canadian cities with the object of promoting the sale of Bermuda produce. His work in this connection and at the Exhibition was done well, and is fully covered in his report which appears on another page.

A trial shipment of Bliss Triumph potatoes was made to England. The tubers arrived in good condition and sold at eight shillings per bushel on 30th March, the shipping charges were four shillings and nine pence per bushel. It was represented that the variety is not popular in the London market, and kidney varieties will be tried in the future.

After much talk for many years arrangements were made in December, 1922, to open in Hamilton during the following month a curb market. The Corporation of the City actively co-operated by providing a site north of the Point Pleasant Hotel, and undertaking to keep it in clean and orderly condition for one year. It was agreed with the Corporation that market hours should be 8 a. m. to 1 p. m. on Wednesdays and Fridays, no charge should be made for the privilege of selling, and sales of all kinds of food and local produce should be permitted. Farmers and housewives were addressed by circular letters, and other efforts made to arouse interest in the market. A farmers' market properly patronized by producers and consumers alike should prove a great benefit to the community. The advantages of direct buying and selling are not yet fully recognized by either party.

As already stated, the agricultural year of 1922 was one unfavourable to Bermuda agriculture, and it is in seasons like the one under report that the evils of the long-continued practice of seasonal credits are most apparent. The economic disabilities which Bermuda farmers suffer are largely due to the fact that they have permitted for long years the buying of their supplies and the selling of their crops to be in the hands of others. Until they take a more intelligent and active part in the business end of farming they will not reap the full benefit of their labours. To quote from an authority on farm management, "The farmer has become a business man." He produces and sells and buys. These operations demand the application of Business priciples in farming. More farmers fail because of poor farm management than because of poor production."

LIVE STOCK

The Annual Agricultural Exhibition should stimulate interest in live stock and encourage the breeding of better animals, and there is evidence that such is the case. To further stimulate the industry draft regulations of a dairy cattle club have been prepared, but no further steps have yet been taken. The Board assisted Mr. B. C. C. Outerbridge, Smiths, in the distribution of some fine Guernsey bull calves. As already noted, the general health of live stock has been good during the year under report. The revival of the tourist trade is increasing live stock in the Islands, and there is evidence of an improvement in quality. The conditions under which some stock is kept leaves much to be desired, and the Society for the Prevention of Cruelty to Animals is performing a service the benefits of which should be recognized by all stock owners.

During the year under report the regulations dealing with the control of infectious animal diseases have been amended.

THE AGRICULTURAL EXHIBITION

After a lapse of fourteen years an exhibition embracing all the features of the shows of the Bermuda Agricultural Associa-

tion was held at the Station on 26th and 27th April. The degree of success which attended the show was largely due to the interest taken in it and the assistance afforded by the entire community, and the occasion is here taken to acknowledge the indebtedness of the Department to those who assisted. The exhibits numbered 964, and the attendance 7,300. It is interesting to compare the parishes one with another with respect to the number of prizes won: Paget, 164; Pembroke, 93; Smiths, 54; Devonshire, 43; Hamilton, 24; Sandys, 18; Southampton, 12; St. Georges and Warwick 10 each. The receipts amounted to £610. 16. 7, and the expenditure to £503. 7. 7.

PUBLICATIONS

A bulletin entitled Common Diseases of Horses, Cattle and Swine, a Handbook for Farmers, prepared by the Government Veterinary Officer, Dr. R. L. Tucker, V. S., was published during the year under report. It is an extremely useful book to owners of the stock named.

Since June the Agricultural Bulletin has been issued monthly. The indebtedness of the Department to the contributors to its pages is here expressed.

The Annual Report of 1921, published during the year under report, is the most valuable one issued by the Board because of the inclusion in it of Prof. H. H. Whetzel's report of local plant diseases and pests and their control.

Though not published by this Department, mention is here made of Prof. Whetzel's very useful bulletin, A guide to the Control of Diseases and Pests of Plants in Bermuda. This is published by the Niagara Sprayer Company of Middleport, New York, and may be obtained from the local vendors of the Company's dusts.

EDUCATIONAL WORK

The educational work of the Department includes public meetings, visits to farms, publication of information in the local press and Departmental bulletins, work with the Agricultural Clubs, exhibitions and demonstration plots at the Station.

During the year under report, nine public meetings were held, including one addressed by Dr. L. H. Bailey in Hamilton in January; six meetings of the Bermuda Green Vegetable Growers' Association were addressed; the Plant Pathologist regularly addressed the meetings of the Garden Club; meetings of Portuguese farmers held at the Station to discuss the introduction of labourers from the Azores were made the occasion of demonstrating dusting, citrus growing and other matters of interest; meetings of importers of seed potatoes were also addressed. Several hundred visits were paid to farms throughout the Colony by members of the Department, and personal contact made with farmers; on some farms demonstrations were made of dusting and co-operative experiments conducted. As already noted, a bulletin on diseases of live stock has been published and the Agricultural Bulletin revived. Copies of the Annual Report for 1922 were distributed to farmers. Articles to the local press have been varied in character,

and have included advice on the control of plant diseases and pests, planting notes, market quotations and other subjects bearing on local agriculture.

Practically all the schools in the Colony were visited at least once during the year. Seed corn was issued to all applicants, and the silver cups were awarded as follows:

Cup presented by the Bermuda Green Vegetable Growers' Association.
Sidney Smith, St. Georges Grammer School.
For best ten ears of corn grown by a boy.
Cup presented by Honourable W. E. Jackson, C. M. G.
Rosalie Lightbourn, Seventh Day Adventist School, Southampton.
For best ten ears of corn grown by a girl.
Cup presented by Honourable J. P. Hand, M.B.E.
For largest yield of corn.
No award made this year.

The Club exhibits at the Annual Agricultural Exhibition were, for the most part, deserving of commendation. Prizes are annually offered for exhibits of live stock, vegetables, flowers, fruits, food products and arts and crafts, and the Exhibition offers a unique opportunity to the children of the Colony to compete with each other in the classes named. A feature of the Exhibition of high educational value was the Plant Pathologist's booth, where could be obtained information concerning modern methods of plant disease and pest control. Similar exhibits were staged at the Villa Mont Clare and Somerset Flower Shows. The potato experiments at the Station were probably the most interesting of any, while the fruit-bearing citrus trees demonstrated to all who saw them the possibilities of fruit growing in the Colony.

STAFF

Few changes have taken place in the staff during the year. In May, Prof. H. H. Whetzel, A. B., M. A., Head of the Department of Plant Pathology of the New York State College of Agriculture at Cornell University, Ithaca, New York, terminated his year's association with the Department. Bermuda was signally fortunate to have received the services of a highly trained and experienced plant Pathologist, whose interest in and assistance to Bermuda agriculture will long be remembered.

Mr. G. E. Winter, for many years Inspector of Green Vegetables, was appointed Inspector of Produce under the provisions of the Agricultural Inspection Act, 1921, and became a whole-time officer of the Department.

On 4th February, the Director was appointed a member of the Immigrant Labour Board.

FINANCIAL

The expenditure of £7,921. 4. 3 was authorized by the Appropriation Act of 1921, and Resolves 1, 14 and 26 of 1922. Of this amount the sum of £6,905. 18. 2 was expended, and a balance of £1,015. 6. 1 remained unexpended. The sum of £68. 17. 4 was received from sales and other sources, and was reimbursed to the Treasury. Statements of the expenditure

under all sub-heads and the receipts will be found in Appendices A and B.

During the last ten years the expenditure by the Department, exclusive of salaries, and the receipts at the Station have been as follows:

Year	Expenditure	Receipts
1913	£2,274. 5. 2	£ 32. 18. 1
1914	3,042. 2. 3	32. 14. 0
1915	2,529. 18. 0	89. 3. 4
1916	2,497. 19.	163. 18. 10
1917	2,045. 5. 7	156. 2. 10
1918	2,051. 8. 0	376. 3. 4
1919	2,722. 5. 8	157. 18. 0
1920	3,128. 6. 6	209. 4. 6
1921	5,488. 15. 2	176. 1. 11
1922	6,905. 18. 2	68. 17. 4

N. B.—The increased expenditure for the last two years was largely due to the control of oleander scale.

Respectfully submitted,

E. A. McCALLAN,
Director of Agriculture.

Agricultural Station, Bermuda,
31st May, 1923.

Report of The Plant Pathologist For The Period January 1st to May 31st 1922.

The Director of Agriculture,

I have the honour to submit the following report on the diseases and pests of plants.

This report is in continuation and completion of the Pathologist's report for the last half of 1921 already before you. The general plan of the work for the year, June, 1921, to May, 1922, for which I was engaged is there set forth, as well as the results for the first six months. It only remains to present a report of the work for the second half year, with recommendations based on a survey of the diseases and pests during that period.

COLLECTIONS

The collection of fungi and insects was pushed as vigorously as the many other projects underway would permit, special attention as before being given to those causing diseases and injuries to plants. As a result of this work the following additions to those already reported were made.

Bacteria. No bacterial pathogenes are to be added to the few reported. Bermuda crops appear to be relatively free from serious bacterial diseases, except for the scab of potatoes and the black rot of cabbage.

About fifteen species of Myxomycetes were collected during the entire year. All have been identified and an annoted list will soon be published. This will constitute the first published list of Bermuda Myxomycetes. Several rare and interesting species were taken. None are new to science, and none are of economic importance in Bermuda.

Fungi. Approximately four hundred species of fungi of all sorts were collected during the entire year. Specimens of these have been largely distributed to experts on the various groups in different institutions in the United States and England for identification. Although good progress has been made on their determination, some time must still elapse before the work can be completed. As soon as possible a complete catalogue of the fungi known to occur in the Colony will be prepared and submitted for publication. Special papers on important groups will appear in various technical journals as fast as work on them can be completed.

A number of species new to science have been found, and most of those collected have not been heretofore known from Bermuda. Prior to 1922 approximately one hundred and fifty species of fungi had been reported from these Islands and practically all were included in the list by Seaver in the Memoirs of the New York Botanical Gardens, Vol. 6, p.p. 501-511, 1916.

A total of forty-two species of rusts was collected, including all those heretofore known from Bermuda; thirty-three more

than were reported by Seaver and twenty-seven not represented in previous collections so far as herbaria examined show. The rusts have been determined by Prof. H. S. Jackson, of Produce University, Indiana, and an annoted list of the Bermuda species will shortly be published. While most of these rusts occur on plants of little economic importance, a few of them cause serious injury to economic plants in Bermuda. The fig rust, **Cerotelium fici,** is the cause of the frequent defoliation of the trees, and is probably responsible for the usual dropping of the fruit. The snapdragon rust, **Puccinia anterrhini** was found in two gardens during the spring of 1921. It is apparently not yet common, but may prove serious in the future. The canna rust, **Puccinia Cannae,** is very common on the common cannas in Bermuda and gives the foliage a brown burned appearance. The peach rust, **Tranzschelia punctata,** is the common cause of defoliation of the peach trees in the Islands. The carnation rust, **Uromyces caryophyllinus,** is frequently severe on certain varieties of carnations and pinks grown in the gardens.

Previously but one smut **Ustilage Zeae,** on corn had been reported from Bermuda. Not a single specimen of corn smut was found during the year 1921-22, though seven other species of smut fungi were collected, none of them, however, of great economic importance. The most common smut is **Ustilage affinis** the one to be found everywhere and at all times of the year in the heads of crab grass, **Stenotaphrum secundatum.** A leaf smut fungus, **Entyloma fuscum,** was found causing severe injury to Shirley poppy seedlings in the gardens at Clifton, Paget.

Among the numerous fungi collected during the second half-year are several others of economic importance. Of these the most interesting from an economic standpoint are: **Cladosporium citri** causing the scab of citrus fruits, **Phyllosticta anterrhini** which causes stem rot and leaf spot of snapdragon, **Sclerotinia libertiana** causing a destructive crown rot of **Arctotis grandis,** and **Cercospora beticola** causing a leaf spot of Swiss chard.

Insects. Over thirty collectings of insects were made during the spring of 1922. Among these were several which proved to be of special interest. The common bulb mite, **Rhizogylphus hyacinthi,** was found on nearly every shipment of bulbs coming in from Europe. A minute thrips, bright red in its larval form and jet black when adult, was discovered to be very common on Eucharis lilies and is apparently associated with the mosiac-like disease which is destroying this lily throughout the Islands. It proved to be a new species. The aphis, **Rhopalosiphum pseudobrassicae,** was very common and injurious to cultivated stocks in Bermuda gardens during the spring. It is held in check to some extent by the minute parasitic fly, **Diaeretus rapae.** The jumping beetle, **Haltica amoena,** was found feeding in destructive numbers on the leaves of **Cenothera tetroptera** in one flower garden.

Over one hundred and thirty separate collectings of insects were made during the entire year and sent away to experts for identification. The total number collected will probably aggregate one hundred and fifty different species. In general only species of some economic importance were collected. Special attention was given to scale insects, a small collection of which, identified

and labeled, has been preserved for reference at the Station. It is hoped that a complete list of the species collected during the year may be published shortly.

DISEASES AND PESTS OF PLANTS

Since most of the common diseases and pests of economic importance in the Islands were treated in the report of 1921, it remains only to consider the few which came to our attention this year, or to add something to what has been said regarding certain of those treated in the previous report.

CITRUS

Scab. This disease is one of the troublesome maladies of citrus trees, especially lemons and grape-fruits in Florida, Porto Rico and other citrus growing countries. It is caused by the fungus **Cladosporium citri.** It has recently been found attacking the avacado in Florida. It was found on the leaves of a single grape-fruit tree in the citrus orchard at the Agricultural Station in the spring of 1922. It was not abundant and was causing little damage. Whether it will prove to be a serious problem should citrus growing in the Islands be revived remains to be seen. It causes a puckering and twisting of the young leaves and a scabbing or warting of the fruit. It may be controlled by spraying with lime-sulphur diluted at the rate of 2 1-2 gallons of the concentrate (32° Baume) to 100 gallons of water. The first application should be made just before the blossoms open, the second application when third or half the petals have fallen and the third spraying seven to ten days later. Where young trees are diseased, more sprayings may be necessary, as they put out new foliage frequently during the year. Spray such trees when new growths begin to develop. Bordeaux mixture may be used with good effect instead of lime-sulphur on young trees or on old trees just before they start new growth.

EUCHARIS LILY

Mosiac. During recent years the growing of Eucharis lilies has become almost impossible, and only occasionally does one see fine flowers of this plant, once the pride of many a Bermuda gardener. It appears to be suffering from a mosiac disease, at least a disease having ear-marks of a mosiac. The affected plants show dwarfed and mottled foliage. The flower stalks are streaked and sometimes dwarfed. The flowers are small, distorted and often blasted, failing to develop. Bulbs of plants once diseased continue to produce bulbs, but all are diseased. No method of control except destruction of all diseased plants is to be recommended.

Thrips. While studying the mosiac disease above described the writer discovered in the malformed flowers a minute thrips, the young are bright red, the adults a shining black. They are considerably larger than onion thrips. The flowers and flower buds are often swarming with them. They are also to be found within the rolled edges of the young unfolding leaves. Mr. A. C. Morgan of the Bureau of Entomology of the United States Department of Agriculture has pronounced this thrips a species new to science to which he proposes to give the name **Physothrips**

eucharii. The writer suspects that this thrips is associated with the mosiac disease as a carrier of the virus. Experiments to eradicate the thrips by cleaning the bulbs thoroughly and disinfecting them in a strong solution of black-leaf-forty (nicotine sulphate) in soap suds gave no results in controlling the mosiac. Dusting with nicotine dust will largely eliminate the thrips in the flowers. Whether the thrips of themselves cause appreciable injury to the lily is doubtful. It is their apparent role as carries of the mosiac virus that makes their presence on this lily dangerous.

ONIONS

Thrips. Onion thrips developed very destructively on the crop during the very dry spring of 1922 and caused severe injury. Some preliminary tests with nicotine dust made by a farmer in Somerset gave indications that if begun early it will effectively control this pest. The dust should be applied thoroughly during quiet periods in the heat of the day.

OLEANDER

Scale. The scale **Aulacaspis pentagona** continues to spread not only in the oleander hedges but also to other plants. A total of twenty-seven host plants on which this pest occurs in Bermuda have been noted: They are: the oleander, peach, pigeon pea **(Canjan Canjan), Argyreia speciosa, Ipomae villosa,** cultivated geraniums **(Pelargonium sp.),** sago palm **(Cycas revoluta),** life plant **(Bryophyllum pinnatum), Cosmos sulphureus,** nasturtium **(Trapaeolum majus), Hibiscus mutabilis, Boehmeria cylindrica,** castor bean **(Ricinus Communis),** an unidentified Malvaceous tree, snapdragon, **Salvia coccinea, Pluchea odorata, Verbena bonariensis, Senecio cineraria, Asclepias currassavica, Solanum Wendlandii,** pumpkin and **Maurandya erubescens.**

It is thus evident that the pest cannot be completely eradicated in these Islands. The spraying project has been successful in holding it in check on the oleanders and saving those hedges that are systematically sprayed on an average of twice a year. This will, however, have to be continued year after year, if spraying alone is to be depended upon.

The parasitic fly, **Prospaltella berlesei,** introduced from the United States and Italy has already become established in several places in the Isands and there is every reason to expect that it will eventually get the upperhand of the scale and reduce its ravages to a point where spraying will no longer be necessary. This will doubtless require several years. Meantime those who desire to preserve their oleander hedges in a presentable condition will find it necessary to spray with limeXsulphur or soluble sulphur solutions. The most effective times to spray appear to be April or May and again in October or November. Spray only those clumps of oleanders which are infested. Nothing is gained by spraying scale-free trees.

PALMETTO

Scale. The white scale, **Comstockiella sabalis,** on the native palmetto, discovered in St. Georges in November 1921, continued to spread and destroy trees in that section. It has not yet appear-

ed elsewhere in the Colony. However, unless prompt measures are taken to destroy all infested trees, this scale may be expected to eventually spread to all native palmettoes, and will probably largely if not completely destroy this beautiful endemic. The people of Bermuda appear to be singularly indifferent to this danger to their native palm.

DUSTING

Considerable interest has been shown by farmers in the possibilities of substituting dusting for spraying, especially in the control of the diseases and pests of celery, onions and potatoes. A number of demonstrations have been conducted in different parts of the Islands, and a goodly number of farmers have given the new method a trial. Promising results have been obtained in the control of celery blight and onion thrips. The late blight of potatoes has been of so little importance due to the dry spring weather that little results of either spraying or dusting for its control have been noted. It is safe to predict that another season will see a very general trial of dusting among Bermuda farmers. There is every reason to believe that dusting will be far more generally used than spraying has been in the past in the Islands.

PLANT DISEASE EXHIBITS

Three exhibits of disease and pest with machinery and materials for their control were made during 1922. The first was staged at the Annual Agricultural Exhibition at Montrose in April. There were many visitors to the booth and the writer was kept busy answering questions and demonstrating dusters. There was great interest in the specimens of insects and fungi shown under the microscope. This exhibit was also put on at the Flower Shows at Villa Mont Clare in Smith Parish and at Somerville in Somerset on May 4th and 11th respectively. The value of such exhibits can scarcely be questioned, and should constitute a feature of all agriculture and horticultural exhibitions of the future.

Respectfully submitted,

H. H. WHETZEL,

Plant Pathologist.

Cornell University,
Ithaca, N. Y.
18th May, 1923.

Report of The Inspector of Produce For The Season of 1921-1922.

The Director of Agriculture,

I have the honour under the provisions of The Agricultural Inspection Act, 1921, to forward my report on the inspection of produce and lily bulbs shipped from the Colony during the season 1921-1922, as well as of seed potatoes imported during the same period and other work performed.

On my appointment to the office of Inspector of Produce on November 1st, 1921, under the provisions of The Produce Inspection Act, 1906, since repealed, my first duty was to inspect the Garnet seed imported from Nova Scotia. Mr. E. L. Adams was appointed Inspector of Green Vegetables on November 15th, 1921, under The Green Vegetable Inspection Act, 1914. On January 1st, 1922, The Agricultural Inspection Act, 1921, coming into operation, I took office as Inspector of Produce, which now included green vegetables, with Mr. E. L. Adams as Assistant Inspector. The export of produce opened with a shipment of 43 barrels of potatoes on November 19th, 1921, and continued without intermission until June 27th, 1923.

INSPECTION OF SEED POTATOES

All seed potatoes imported into these Islands were inspected by the Inspection Service. A total of 6,799 barrels of Triumphs was imported, chiefly from Long Island, New York, but included small quantities from Fredericton, New Brunswick, and Batavia, New York. The Long Island stock was in good condition and fairly true to type, the New Brunswick stock was good both in shape and colour, and the Batavia stock was in type, colour and pack very good. A total of 7,094 barrels of Garnets was imported from Nova Scotia. With few exceptions these were found to be of good quality and true to type. Most of the barrels in the last shipments were well filled, an improvement on the earlier shipments.

INSPECTION OF PRODUCE

Potatoes. Taken as a whole the crop of potatoes was far below the average yield of several years. The grade of both Triumphs and Garnets was small, and the colour, especially of the latter, was poor. This fact, militated heavily against the crop in the New York Market. The smallness of the crop was primarily due to the dry season which prevented growth at the most critical period; and this also influenced the colour. Whatever defects were in the seed were accentuated by the drought which by arresting the development of the plant deprived it of the means to overcome any weakness inherent in it. On the other hand the dry weather by diminishing blight contributed to the keeping qualities of the crop.

Onions. The crop of onions was light, for the same reason

as that which affected the potato crop. The quality, however, was perhaps superior to any seen in the Colony for several seasons back.

Green Vegetables. The green vegetable season opened with the shipment of 51 crates on December 3rd, 1921, and closed with a shipment of celery on June 27th, 1922. The chillroom accommodation, as during the previous season, was amply sufficient for all demands.

Beans, Fava. Fava beans were affected by a disease which disfigured the pods, and by its unsightly black appearance told heavily against the sales.

Beets. Beets also showed improvement, although the heavy-topped and light-fleshed varieties were still in evidence.

Carrots. An improvement in the carrots was due to the almost total absence of the short variety which finds but little favour in the New York market.

Celery. On the whole the crop of celery was poor. For this blight was chiefly responsible. The disease was most observable in the western parishes, Warwick being most seriously affected.

Lettuce. The lettuce crop can be described only as a complete failure. In my opinion two causes may have contributed to this state of affairs, either the seed was of bad quality, or there was lack of proper care and cultivation. Probably both causes operated.

Parsley. Parsley was good. Most of the defects of the previous season was remedied, and there was a very marked improvement generally.

Produce Rejected on First Inspection. The percentages of rejections on first inspection of produce were as follows: Potatoes, 7.3; onions, 1.8; celery, 4.2; other vegetables 1.7. The bulk of the produce rejected on the first inspection was made good with respect to the defects found in it, and was ultimately shipped.

References and Appeals. None
Prosecutions. Two.

Space for Re-packing. I have as usual to thank the Wharfinger, Captain N. E. Holmes, for the allotment of space for repacking, as well as for his kind cooperation in oversight of the chillrooms.

INSPECTION OF LILY BULBS

In the early part of July I was employed in the work of inspecting lily bulbs. Thirty visits of inspection were made to the packing sheds. The bulbs on the whole were good ; some lots were very good, and some few lots were only fair. The quantities shipped will be found in the tabulated statement attached.

SUMMER EMPLOYMENT

In addition to inspecting lily bulbs for export, I was engaged during the summer in supervising Agricultural Club work, revis-

ing the agricultural registers on file at the Station office, visiting farms, and so on. Full reports of my work in these connections were presented monthly.

SUPERVISION OF CHILL ROOMS AND MARKET INVESTIGATIONS

From February 4th to June 12th, I was in New York employed in investigating market conditions there, in observing the state of the shipments on arrival and exercising a general supervision over matters affecting the industry. A full report covering this period has been previously forwarded, and the following abstracts are included in this report:

Remarks. Discharging from ship to dock was carried out by an improved method and was quite satisfactory.

Texas, as mentioned in my last report, is now in the field and a strong competitor. I would again urge that farmers should ship only the best quality and pack in the most attractive manner.

This season the potatoes showed very little rot, but many showed a lack of colour, betraying want of care in storage on the part of the Bermuda farmer as regards the Triumphs, while the Garnets were small in grade and poor in colour, in consequence I believe of the dry season. If the potato crop had reached the proper standard in size and colour, at least a dollar more per barrel would have been realized.

I desire to express my appreciation of the courtesy and consideration shown me in the discharge of my official duties in New York by the officials of the Furness Bermuda Line.

Recommendations. 1. I would again call the attention to the desirability of introducing other kinds of vegetables for export to the New York market. As a general rule the market will accept larger quantities of the following: Fava and other kinds of beans, kohl-rabi, peas and turnips. The following vegetables command good prices as a rule, and experimental plantings and shipments are recommended: asparagus (in February and March), cucumbers, egg-plant, okra, spinach (in January) and tomatoes.

2. As stated in my previous reports, I feel sure that a reduction of the number of receivers at New York would result in better prices for our produce.

The celery crop should not go into the hands of more than two receivers. I feel sure that the celery industry would benefit substantially from a financial point of view if the product were handled in this way.

3. I would urge again the cutting out of No. 3 grade potatoes. This grade is hard to sell at any time and is often unsaleable altogether.

4. To compete on the most favorable terms with our competitors I would strongly recommend a standard pack of all vegetables. With regard to beets and carrots a standard pack is imperative. Standard packages throughout is recommended.

EXPENDITURE

For the expenditure or inspection service, supervision of chillrooms, market investigations, etc., see Expenditure on another page.

RECOMMENDATIONS AND SUGGESTIONS

With respect to seed potatoes I have to remark that whilst on the whole the importations were of good quality and fairly true to type, there was in many cases an obvious lack of care in the matter of packing and grading.

In the matter of vegetable seeds, whilst the importers no doubt do all they can in the circumstances the results are not all that could be desired.

Much the larger portion of the lily bulbs which I inspected were of the true Harrisii type and of excellent quality but some came under my observation which, in my opinion, are not worth a farmer's while to spend time in cultivating.

I have to express my thanks to Assistant and Sub-Inspectors for the valuable work they did during the season, and especially to Mr. E. L. Adams who acted as Assistant Inspector-in-Charge during my absence in New York.

Respectfully submitted,

G. E. WINTER,
Inspector of Produce.

Devonshire, September 30, 1922.

QUANTITIES SHIPPED

The following quantities of produce were shipped:

	Canada	West Indies	United States
Beans, Fava			1,537
Beans, String			9
Beets			21,947
Carrots			76,348
Celery			28,403
Kale			12,397
Lettuce			3,322
Onions	21,323	12,080	37,471
Parsley			46,267½
Peas			22½
Potatoes		1,652	41,999
Turnips			612
Miscellaneous	941		

Totals

Green Vegetables	191,806 bushel crates
Onions	70,874 bushel crates
Potatoes	43,651 barrels

	Canada	United States
Lily Bulbs	20 bus. Amaryllis	354,040
	1 bus. Oxalis	Harrisii
	1600 Harrisii	

Report of the Government Veterinary Officer for the year 1922.

The Director of Agriculture.

I have the honour to make the following report for the year ending December 31st, 1922.

The Colony has been practically free from any serious contagious or infectious disease among live stock, with the exception of contagious abortion. This disease made its appearance in different dairies. Very stringent measures are in force to prevent its spread, and I cannot lay too much stress on the importance of enforcing these measures, for the effects of this disease on the dairy business are disastrous. In some districts in the United States, where it is present, the production of milk has been abandoned. During the month of January influenza affected quite a number of horses. This disease is always more or less prevalent in the Colony during the winter months, and this is due to the overcrowding of sales stables in the States from which country most of our horses are imported. No hog cholera has made its appearance within the year. During the years 1914 to 1916 the disease was running rife in the Islands, but because of rigid sanitary treatment of all imported animals, together with inoculation, it is unknown today. This freedom, however, should not cause us to become lax in our inspection and quarantine measures.

To the best of my knowledge and belief, the following live stock were imported during the year under report: 220 horses, 25 cows, 32 hogs, 60 dogs and many hundred head of poultry. All the imported animals were inspected in accordance with the regulations. The quality of the live stock imported was far above the average of former years, the class of driving horses in particular being very much better than in preceding years. One has but to visit our annual agricultural exhibitions to note this. Farmers are gradually improving their dairy stock, and are beginning to realize the superiority of pure bred stock. It is very gratifying to realize that our present Governor is fully interested in the improvement of live stock and other matters connected with agriculture.

I beg to report on the condition of the chill-rooms used for the storage of meats. These are nearly all that can be desired. On all my visits I have never yet had to complain in any way of conditions. In my opinion few, if any, alterations for the better could be made. I have always found them clean and thoroughly sani-

tary, and down to the required chilling point. In my opinion the food products sold in the different meat markets for human consumption are far above the average elsewhere.

In conclusion, I wish to thank the Board and Director for the manner in which they have always supported me in all matters bearing on the control of animal disease or in any way touching live stock.

Respectfully submitted,

R. L. TUCKER, D. V. S.
Government Veterinary Officer.

Smiths,
June 8th, 1923.

Report of Second Agricultural Assistant on Bermuda Exhibit

At the Canadian National Exhibitian, and Investigations of the Canadian Market for Bermuda Produce

The Director of Agriculture.

The Exhibition. Fresh exhibits to be used in the Bermuda booth at the Canadian National Exhibition were shipped from Bermuda on the S. S. Canadian Forester on August 12th. The Department of Agriculture's contribution consisted of tubbed plants, nursery stock, vegetables and fruit.

The Second Agricultural Assistant sailed from Bermuda on August 15th and arrived in Montreal on the 18th. The Bermuda exhibits were cleared at Customs and arrangements made for their immediate dispatch to Toronto. On the 19th arrangements for the necessary work to be done to the booth were commenced. The exhibits stored from last year's exhibition in the Canadian National Exhibition warehouse were found to have kept in excellent condition, but the plants left in the Park Commissioner's glass houses were nearly all passe, in fact, none of them were used in the Bermuda exhibit this year. The opening of the Exhibition on August 26th found the Bermuda booth ready for visitors. Owing to the high cost of erection, it was decided to leave the major part of the exterior of the booth similar to the arrangement of last year, but some changes were made which added quite a distinctive aspect to the booth. The colour scheme was very must better than that of last year, the colours used being green and white, Bermuda's colours. The entire eastern end of the booth was taken up with the agricultural display. Many were the compliments paid the Bermuda representatives on the arrangement and colour scheme of this booth. The staging of the agricultural exhibits was the cause of much interest and comment. All vegetables were displayed in excellent exhibition jars, in which they were packed in chemicals. The jars were staged at advantage on a suitable stand erected across the full width of the booth. It was considered quite a compliment to receive a request from Senor E. Fernendez, Consul General for Venezula, for the "secret" of colour setting and preserving the natural shape of the vegetables and fruits. The leaflet "Canada's Clarion Call Re-echoed in Bermuda" which was distributed freely, drew considerable attention to our vegetables, and to this was added talks on the subject.

It is impossible to estimate in figures the amount of good to Bermuda accomplished by the exhibit, but both representatives were at the booth every day for the two weeks and from the interest shown, it is felt certain that increased business with the Dominion during the coming season will result.

Investigation of Markets. The objects of the investigations were, to promote sales of Bermuda agricultural produce in the

Dominion, to secure the co-operation of the various merchants in handling Bermuda produce, to interview various produce merchants and brokers in the different centres with the view of making recommendations regarding firms suitable to handle Bermuda produce in Halifax, Montreal and Toronto, these being judged the best distributing centres, to visit railroad and steamship companies and enlist their co-operation in placing Bermuda produce on the different markets in the least possible time and in the best condition.

At the outset a word of appreciation must be expressed for the courtesy everywhere shown and assistance given to the Department of Agriculture's representative. Special mention should be made of Mr. R. E. Armstrong of St. John, Mr. Norton, Freight Agent for Maritime Provinces for Canadian National Railway, Mr. Cowan, Export Freight Manager, Canadian Pacific Railway, Mr. Cote of the Board of Trade, Quebec, and Mr. Clemens of Clemens Bros., Toronto, without whose assistance it would have been impossible to cover the territory in so short a time. In all the places visited Bermuda produce, principally onions, had been on the market at some time or the other, and in Quebec, in the warehouse of the Quebec Fruit and Fish Co., were found three crates of Bermuda onions in fairly good shape.

A very pronounced desire to trade within the Empire whenever possible was expressed everywhere. After reviewing the whole situation as revealed by the visits made and numerous talks with leading business men and others in the various cities, the following conclusions are submitted:

There is a market for Bermuda produce in the Eastern Provinces of Canada, principally the Maritime, but it has to be educated. While Montreal, Toronto and Hamilton naturally are the largest markets in this part of Canada, in these cities we meet with a very strong competition, viz, from Tennessee and the regions of the Missisippi. Fresh vegetables of all kinds are shipped from these centres in through refrigeration cars, which, as there is no handling other than that of loading at the place of origin, places the goods on the market in the very best of condition, while Bermuda produce, having to be handled so often between shipping port and destination, and at each handling depreciating in appearance if not in quality, has to take the second place when put on the market alongside the bright and fresh appearing package from the South. With the onion in the above-named three cities a like condition prevails, it being possible for the Texas grower to ship direct from the packing centre to the market in through cars and to place his goods on sale in as fresh looking an appearance as when they left his hands. The Texas onion is handicapped by having to pay a high rate of duty when entering Canada, while ours enters free, but that is offset to a large degree by the long haulage and high freights that we have to make and to pay, and the regularity with which the Texas goods can be put on the market. Greater obstacles than these have been overcome though, as for example, the achievments of the California Fruit Growers' Association, who in the beginning had to overcome not only competition from outside countries and long hauls, but the problem of successful packing, as their fruit used to arrive on the market at least 40

per cent. rotten. Today, as the result of their unrelenting activities and persistent advertising, their oranges, with their trade mark "Sunkist" are known and control the market in every city of the United States of America and the Dominion of Canada.

What they have accomplished with fruits can be duplicated in a more or less degree by adopting their successful methods of co-operation and systematic marketing. Without some such system the marketing of Bermuda produce in Canada or elsewhere, will, always be a hit or miss proposition. There is a decided opposition among produce importers to the changing of channels of supply that are already established and are reliable, for others that are as yet an uncertainty. Fruit from California and Florida, onions from Texas, fresh vegetables from Tennessee and the Missisippi valley, and tomatoes from Florida and Mexico, now come on the Canadian markets in a regular supply, and our vegetables must compete with these. The agents of the Canadian Pacific Railway Co., the Canadian Government Merchants Marine, Canadian Government Railways and the Royal Mail Steam Packet Co., have offered their closest co-operation to the Bermuda shippers in assisting to place Bermuda produce on the various markets as quickly and as safely as possible. In this connection the Canadian Pacific Railway Co., is prepared to provide chillroom space for the carrying of green vegetables, if the trade will warrant the cost of installation. The present cost of installation per ship is approximately five thousand pounds.

The demands of the markets in the different centres in the territory covered differ greatly. In Halifax and St. John, onions, tomatoes, carrots and cabbage are in the greatest demand; in Quebec a white onion goes begging as long as there is a red onion on the market, and fresh vegetables in the winter time are very little used, although with the population there and in the vicinity there should be a good demand. There is a field there if educated. Ottawa handles fancy vegetables in medium quantities only when the Houses are in session, at other times there is practically none, except from the farmers nearby. Montreal, Toronto and Hamilton can use practically the same lines as New York, only in these places, too, in limited quantities. A cargo of mixed produce such as is shipped into New York weekly during the winter season would have to be distributed throughout all the cities named, and that very judiciously. No figures could be obtained relative to the quantities of green vegetables that could be profitably handled each season in all or any of the centres, but with onions the following figures have been arrived at by taking the concensus of opinion expressed by the various handlers.

Halifax,	per	fortnight	3,500 crates
St. John,	"	"	1,000 "
Quebec,	"	"	1,500 "
Montreal,	"	"	2,000 "
Ottawa,	"	"	500 "
Toronto,	"	"	2,500 "

The Bermuda potato will have to be introduced in Canada, except in one or two exceptional cases, as a red skin potato at present is a very poor seller.

Although the majority of those interviewed expressed a rather pessimistic opinion in regard to Bermuda finding a successful market for her winter grown vegetables in Canada, from the result of my investigations I am inclined to think more hopefully. Although great quantities of vegetables are grown in Ontario and the Maritime Provinces, Canada annually imports from the United States a little over a million and a half bushels of miscellaneous green vegetables, of these the largest part is imported in the winter. Providing we can solve the problem of how to get our goods on the market in good condition, and when wanted, and at a price that will compare favourably with the Southern grown stuff, I feel confident, from the strong feeling expressed to trade within the Empire whenever possible, that our goods will receive a receptive market and be given the preference.

In marketing our produce in Canada we must bear in mind that the market is new, our goods are not very well known, there are others there that have given satisfaction, and consequently the utmost care should be taken to have everything in as an attractive appearance as possible. It is the container that sells the goods in nine cases out of ten. I would recommend that a thicker slat be used at the top and bottom on either side of our onion crates, possibly a double slat would serve the purpose. This would tend to keep the sides of the crates cleaner and would insure better ventilation when stored. Tomatoes should be packed in six basket containers, viz, six 6 pound baskets packed in a special crate and they should be wrapped in a standard wrapper. All Bermuda produce should be clearly marked with some official trade mark. Every package, wrapper, basket, crate or barrel used should bear some accepted Bermuda trade mark. Canadians want Bermuda goods, but too often others are imposed on them instead.

Respectfully submitted,

JOSEPH J. OUTERBRIDGE,

Second Agricultural Assistant.

Agricultural Station,

October 2nd, 1922.

Report and Recommendations of Prof. H. E. Babcock, Ph. B.,

Professor of Marketing, Cornell University, on Marketing Bermuda Agricultural Products.

To Mr. E. A. McCallan,

Director of Agriculture, Bermuda.

I have purposely delayed writing this report until I had been away from Bermuda long enough to free myself as much as possible from its local influences. All of my recommendations, as you realize, are based on observations rather than studies, and on only the briefest contact with your problems. I trust that whosoever reads this report will remember this and out of justice to myself, take it into consideration.

Land Ownership. To begin, I believe that Bermuda is faced with the results of an unsound economic policy toward agriculture under which its agricultural lands have passed from the hands of owning operators to tenant farmers. Nothing would do so much to stabilize the agriculture of Bermuda as the adoption of a policy to encourage and make possible the ownership of the agricultural lands by the men who till them. I am not sufficiently familiar with your credit situation to know whether or not anything is needed in the way of credit facilities to enable the better class of tenant farmers to acquire their farms, but **I am sufficiently familiar with your marketing situation to know that some savings must be effected immediately in your marketing costs, if farmers are ever to pay up their back debts, to say nothing of finally acquiring ownreship of the lands which they till.** As I understand the situation, your farmers owe very much more in current bills than your next year's crop, which has not yet been financed, will bring.

Cheaper Production. Some savings are no doubt possible in your production costs. It would seem that the use of more machinery, the better control of plant diseases and the introduction of crops which would tend to distribute the labour load and broaden the market, might be worth while considering in this connection. More effective than any of these, however, will be the development of an initiative and an ambition upon the part of the farmers themselves, which will only come through land ownership and an ability to finance themselves independently, instead of having to work under a system of seasonal credit extended by merchants.

Grading and Packing. The grading and packing of your agricultural products are the first two direct marketing services performed on them and are both performed by the producer himself. Bermuda is to be congratulated upon its excellent grading legislation, and the thoroughness with which it is enforced. It is probably the most successful example of grading by legislation that exists anywhere. Grading by legislation will never be as

satisfactory as the grading done by the growers themselves in a co-operative way. However, because of the peculiar circumstances prevailing in Bermuda, I have come to the conclusion that you have established grades through legislation that, except for the minor suggestions that I will make, are sufficient for the time being. **Certainly it is not here that your greatest opportunity for improvement lies.**

The same is true of your packages. For the most part these have become well established in the trade and are well adapted to the products which you ship. Concerning both grading and packaging I have the following recommendations to make:

—Withdraw recognition of the number three grade. Consider the establishment of a fancy grade, and modify grades 1 and 2 so that the bulk of the crop will pack fancy No. 1 and No. 2.

Beets—Develop requirements for a standard bunch and require a standard number of bunches to the crate. Just as a suggestion, two sizes of beets might be bunched that would each run a standard number of bunches to a crate.

Crates—Use hard wood stock; buy the whole order for the Islands in one lot.

Barrels—Work toward the end of introducing a standard Bermuda barrel. Since it is important to use the barrels in which seed potatoes are shipped, attempt to get potatoes imported in the type of barrel which is most desirable to use for your export trade.

Assembling. From the standpoint of horse and man labour, the assembling of your agricultural products is very expensive. Small loads are hauled long distances and horses are hard driven. As internal or water transportation is developed in these Islands, the need for cutting down the costs of assembling your agricultural products at the dock at Hamilton should be kept in mind. I have no suggestion other than this to offer at this time, as there seems to be no practical one to make.

Forwarding. There is no excuse for the number of forwarding agents now operating on the dock at Hamilton. Their presence there adds to the confusion; they perform little real service and their commissions constitute an unwarranted charge on the agriculture of the country. **It is my recommendation that the Government establish a forwarding service to operate at cost and that legislation be passed requiring all forwarding to be done through this service.** This would still permit Front Street merchants and agents of New York houses **to purchase on their own account and forward in their own name,** but would remove them from the dock and would give to the farmer two choices, either an outright sale in Hamilton or an opportunity of direct consignment through a Government agency operating at cost.

I realize that this recommendation will not be popular either with the Bermuda Green Vegetable Growers' Association, who already exist for the purpose of forwarding at cost and who gain considerable advantage through the fact that they rebate part of their charges, or to the forwarding houses and the many small agents to whom the commission now charged amounts to considerable, but if it is followed out, **it will at once remove the main rea-**

son why Bermuda produce is sent to so many receivers in New York City and remove an unnecessary tax on the agricultural products leaving the country. At the same time all interests in Bermuda would be left on an equal basis and free to practice direct competitive buying either in their own or joint accounts.

Transportation. A Government controlled forwarding service, such as I have suggested or in case such a scheme is too paternalistic, a co-operatively maintained service, which would have charge of the assembling and loading on the boat of all of Bermuda's agricultural products, would place shippers in a position to deal in an effective manner with the steamship company both as to rates and quality of service. Savings are possible under both of these heads.

Receiving Houses. The consensus of opinion both in New York and in Bermuda is to the effect that there are entirely too many houses receiving Bermuda products in New York City. A great deal of talk was heard at both ends relative to cutting the number down to five or six. This is probably desirable, but in my judgment impossible of accomplishment under your present system, which allows any New York house which so desires to place an agent either to forward for it, or to purchase products on joint account on the dock at Hamilton.

It is my judgment that if my recommendation relative to receivers is carried out that this situation will correct itself, for under it farmers would either forward direct, and thus learn to select the efficient houses, or sell to New York agents in Bermuda who in turn would have to have good sales service in New York or be forced out of business at the Bermuda end by competition.

As the single forwarding service functions, data should be gathered and the marketing of Bermuda agricultural products studied with the object of determining whether it would not be wise ultimately to have a single receiving agent also in New York City who would have full authority to place the products with such houses as he saw fit and to develop and distribute to outside markets.

Any such arrangements, however, would have to be based upon a willingness to pool prices, and I feel that the interests now engaged in marketing Bermuda agricultural products are not yet ready for such a step. Certainly they would never be willing to become parties to such co-operation, unless they are first willing to take the initial step which I have recommended, namely, to establish a single forwarding office to operate at cost and to be utilized by all shippers whether shipping products of their own growing, or products which they have purchased on their own or joint accounts.

Respectfully submitted,

H. E. BABCOCK,

Professor of Marketing.

Report of Committee on Labour

Cornell University,
Ithaca, New York,
May 5th, 1922.

The undermentioned committee was appointed by the Board of Agriculture at a meeting held on September 12th, 1922, to bring to the notice of His Excellency the serious shortage of labour in the Colony, and disastrous effects of such shortage on agriculture.

The existing shortage has steadily grown worse since the cessation of the War, and the return of normal conditions in these Islands. The resumption of the tourist trade and of building operations more particularly has absorbed a large proportion of the available local labour, which at the time of the cessation of hostilities was less abundant than in pre-war days. Men heretofore employed largely in agriculture have been attracted to employments associated with the tourist trade, because the work is better paid, is cleaner and less arduous, and is performed under more congenial conditions. Tipping has attracted many to seek employment as drivers, waiters, and the like. The building trade, and especially the works carried on by the Bermuda Development Company, has taken many agricultural labourers. The Company named, either directly or through its contractors, has offered wages, both for time and piece work, above the local rates, and such that agriculture can never offer.

The committee is of opinion that the Development Company, and all other large employers of labour, should be encouraged to import some of the men required by them. It is also recommended that inducements be offered to British mechanics and trade labourers to seek employment in Bermuda by offering them assistance in their passage money, and in other ways.

It is realized that in the matter of wages, agriculture cannot expect to compete with the trades named above. To ameliorate this condition, it is recommended that there be imported for agricultural work men who are primary land workers, and who have been on the land for many generations, and to offer these men special inducements to remain on the land in Bermuda. Among these inducements, the opportunity to become small farmers themselves appears likely to be the most attractive. The payment of bonuses and profit-sharing are likely to retain many, but the chance to engage in farming "on their own," even in a small way, may be calculated to hold more men on the soil than will any other inducement. Under the labour conditions that are likely to obtain in Bermuda from now on, it appears that family-farming,

that is, farms of a size that the family can do most of the work, are likely to prove most profitable. Land-owners should be able to secure the cultivation of their farms by providing proper housing conditions, financial assistance, oversight, and an equitable system of profit-sharing to families of the character indicated above. The older boys of these families, and the men whose farms would not give them constant employment, should constitute a class from which the larger farms could draw for labour.

To introduce labour of this character and to assist them to become established presents many difficulties which we are not prepared to treat in detail just now, though we are confident that this or similar scheme offers the only lasting solution.

We desire to point out that the bulk of the farming now done in the Colony is by men of Portugese extraction. These men have little national spirit, and it should be a comparatively easy task, and certainly a desirable one, to make of them British subjects. As a means to this end, it is recommended that the procedure required of them to obtain naturalisation should be made simple and inexpensive. As a people they are law-abiding, hard working and thrifty, but are at present with practically no sense of the responsibilities of citizenship.

In selecting people to place on the land it would be necessary to choose men who could be employed by Portugese farmers, and who are of a race that would ultimately make desirable colonists. We are unable to suggest from what locality these men could be drawn.

A feature connected with labour to which attention is directed, is the growing scarcity of labourers' cottages. In many localities, and especially is this true of Paget, many cottages that once housed labouring people have been renovated and are now rented to tourists as winter houses. This presents but another difficulty in labour conditions.

His Excellency has suggested that the time-expired men of the Garrison should be made acquainted with the nature of Bermuda agriculture, and induced to settle here. We are of opinion that this suggestion is an excellent one, and should be acted on.

In conclusion, it is pointed out that land is going out of cultivation, and much that will be put under the plow this season will be cultivated indifferently. After two bad seasons, the majority of the farmers of the Colony are in debt, and what is more serious, are discouraged and apprehensive of the future. As a measure of the reduced acreage that will be put under cultivation this season, it is stated that less han 14,000 barrels of seed potatoes will be imported, a reduction of about 6,000 barrels. Similar reductions are taking place in the importation of all other farm supplies.

Nothing is of equal importance in the re-establishment of agriculture than is the introduction of a satisfactory type of labour, but other matters of importance are the reduction of the cost

of production, improved marketing conditions and the extension of our markets.

Agriculture now supports directly and indirectly about one-third of the Colony's population. Our annual agricultural exports are at present worth in the neighbourhood of £250,000. We are of opinion, however, that unless labour and other conditions are speedily improved, agriculture must of necessity decay.

E. F. ZUILL,
B. C. C. OUTERBRIDGE,
Members, Board of Agriculture.

Agricultural Station,
October 9th, 1922

E. A. McCALLAN,
Director of Agriculture.

Appendix A.

Expenditure (Exclusive of Salaries) For The Year Ended 31st December, 1922.

1. PAYMENT OF MEMBERS OF BOARD

Appropriated by Appropriation Act, 1921				£80.	0.	0
Paid to Members for attendance	£56.	16.	0			
Unexpended balance	23.	4.	0			
	£80.	0.	0	£80.	0.	0

2. GENERAL GRANT

Appropriated by Appropriation Act, 1921				£2200.	0.	0
Clerical and technical assistance	77.	19.	9			
Field labour on experimental plots, lawns, flower beds and glasshouses and for care of dairy stock	1141.	1.	2			
Cartage and plowing	65.	19.	3			
Manure and fertilizers	92.	17.	9			
Seed potatoes, seeds and bulbs	92.	7.	8			
Insecticides and fungicides	26.	0.	5			
Live stock, feed	221.	17.	4			
Live stock, incidentals	20.	6.	3			
Repairs and renewals of tools, buildings, etc.	135.	4.	1			
Cleaning offices, etc.	13.	15.	0			
Electric light and power	13.	15.	8			
Telephones	6.	10.	0			
Books and periodicals	24.	0.	6			
Stationery and office supplies	20.	8.	2			
Printing	127.	10.	6			
Postage, foreign	28.	0.	0			
Agricultural Clubs, prizes to	8.	12.	0			
Canadian National Exhibition, contribution to expense of Bermuda exhibit (exclusive of labour)	58.	4.	6			
Miscellaneous	2.	1.	6			
Unexpended balance	23.	8.	6			
	£2200.	0.	0	£2200.	0.	0

3. INSPECTION SERVICES, MARKET INVESTIGATIONS AND CONTINGENCIES

Appropriated by Appropriation Act, 1921				£1250.	0.	0
Inspection at dock	533.	8.	7			
Inspection of seed potatoes in Canada and the United States, etc.	150.	11.	4			
Representative at New York Market	192.	18.	11			
Investigation of Canadian Market and representation at Exhibition	136.	9.	11			
Special Market Investigations by Prof. H. E. Babcock	64.	11.	8			
Representation at Bulb Conference, Washington, D. C.	25.	10.	9			
Cables	26.	15.	11			
Supplies and contingencies	63.	9.	8			
Unexpended balance	56.	3.	3			
	£1250.	0.	0	£1250.	0.	0

4. ERADICATION OF ANIMAL DISEASES

Appropriated by Appropriation Act, 1921				100.	0.	0
Compensation to owners of condemned stock	7.	0.	0			
Supplies		6.	10			
Unexpended balance	92.	13.	2			
	£100.	0.	0	£100.	0.	0

5. TRAVELLING EXPENSES OF OFFICERS OF DEPARTMENT

Appropriated by Appropriation Act, 1921				40.	0.	0
Carriage hire	38.	18.	6			
Steamer fares		8.	6			
Unexpended balance		13.	0			
	£40.	0.	0	£40.	0.	0

6. IMPROVEMENT OF LIVE STOCK

Appropriated by Appropriation Act, 1921				100.	0.	0
Bonus to owner of registered bulls	37.	11.	3			
Supplies	1.	0.	0			
Unexpended balance	61.	8.	9			
	£100.	0.	0	£100.	0.	0

7. PURCHASE OF SCIENTIFIC APPARATUS AND BOOKS

Appropriated by Appropriation Act, 1921				100.	0.	0
Apparatus, books and contingencies	90.	4.	6			
Unexpended balance	9.	15.	6			
	£100	0	0	£100.	0.	0

8. ANNUAL EXHIBITION

Appropriated by Appropriation Act, 1921				200.	0.	0
Labour, material and contingencies	200.	0.	0			
	£200.	0.	0	£200.	0.	0

9. PURPOSES OF THE PLANT AND BULB DISEASES AND PESTS ACT, 1921.

Appropriated by Appropriation Act, 1921	2000.	0.	0			
Appropriated by Resolve No. 14 of 1922	1090.	0.	0			
Appropriated by Resolve No. 26 of 1922	750.	0.	0	£3840.	0.	0
Labour and horse hire	2015.	19.	6			
Insecticides	785.	13.	3			
Equipment and contingencies	290.	7.	4			
Unexpended balance	747.	19.	11	£3840.	0.	0

10. RESOLVE NO. 1 OF 1922

Appropriated by Resolve No. 1 of 1922				11.	4.	3
Squill bulbs purchased in 1921	11.	4.	3			
	£11.	4.	3	£11.	4.	3

E. A. McCALLAN,
Director of Agriculture.

Appendix B.

Statement of Reimbursements To Government and Produce Supplied To Other Government Institutions During The Year Ended 31st December, 1922.

REIMBURSEMENTS TO GOVERNMENT

Sales of potatoes, vegetables, plants, etc.	£32.	17.	4
Live stock fees	36.	0.	0
	£68.	17.	4

PRODUCE SUPPLIED TO OTHER GOVERNMENT INSTITUTIONS

Vegetables, King Edward VII Memorial Hospital	22.	0.	0
Vegetables, Hamilton Goal	18.	15.	0
Vegetables, Lunatic Asylum	6.	5.	0
Milk, King Edward VII Memorial Hospital	111.	10.	0
	£158.	10.	0

E. A. McCALLAN,
Director of Agriculture.